

**ENVIRONMENTAL STATEMENT  
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Prepared by: Dr Andre Aptroot

Approved by: Dr William Latimer

Dunedin House, 25 Ravelston Terrace, Edinburgh, EH4 3TP  
Telephone: 0131 311 4000 Fax: 0131 311 4090 Website: <http://www.fabermaunsell.com>

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# Summary

In October 2006 Dr A Aptroot of the Adviesbureau voor Bryologie en Lichnologie, Soest, Netherlands, conducted a specialist survey of the lichen species found on St Helena in order to determine the impact the proposed airport development may have upon this group of flora. The survey comprised a detailed inspection of the development site at Prosperous Bay Plain in the east of the island, together with the corridors of access/haul roads and a possible quarry site at Rupert's Valley. Contextual information, whereby the ecological interest of the lichens has been evaluated, was derived from additional survey work throughout St Helena and on Ascension Island, from a review of the scientific literature and from examination of the reference collection of lichens at the Natural History Museum, London.

Lichens form a prominent component of the flora of St Helena. In much of the south and east of the island they frequently dominate the plant community, growing in abundance on rock surfaces or consolidating desert sands in crust formations.

The survey work undertaken has revealed a number of lichen species endemic to St Helena 8 of which occur within the areas affected by the airport development. Together with another 7 non-endemic species, these species are present in diverse associations or as abundant single-species patches. They are particularly common on the boulder fields on Prosperous Bay Plain and on the coastal and valley cliffs (endemic *Dermatiscum* and *Ramalina* spp). The lichens forming soil crusts on the fine desert sands (endemic *Dimelaena* and *Xanthoparmelia* spp.) were noted as being the habitat most sensitive to disturbance from vehicle movements and trampling.

While the endemic species in particular are of special scientific interest, they are well distributed throughout specific habitats on St Helena and can, in the local context, be considered frequent or common. The airport development is, therefore, not considered to represent a potential threat to the long-term survival of any of the endemic and indigenous species.

Nevertheless, given the inherent interest in this specialised flora, avoidance where possible is recommended (e.g. haul and access road alignments). Where such avoidance is not possible, lichens may be transferred by translocation of the thallus (the 'body' of the lichen) or the colonised substrate to an area of safety where similar environmental parameters are present. Protective fencing should be instated in areas outside the development site where lichens are common, or sensitive communities and species are present.

Key areas for the mitigation described above were identified as:

- The Central Basin of Prosperous Bay Plain (protect soil crusts by fencing)
- Dry Gut, upstream of the runway extension embankment.
- Great Stone Top (site for remote navigation lighting) is the only location in St Helena for several non-endemic species which occur on the top and nearby sea cliffs.
- The Pipe Path, Rupert's Hill, with the endemic *Xanthoparmelia beccae* and the rare but non-endemic *X. wildeae*. The haul/access road alignment should take account of these areas.

# 1 Introduction

This report has been prepared by Dr André Aptroot of the Adviesbureau voor Bryologie en Lichenologie in the Netherlands. The study was commissioned jointly by the St Helena Government and the Department for International Development (DFID) for an Environmental Impact Assessment of the St Helena Access Proposals being undertaken by Faber Maunsell.

Lichens occur world-wide in terrestrial habitats. Although they are most conspicuous and best known from arctic, alpine and boreal regions, they are most species-rich in the tropics, and occur also in temperate and subtropical regions including deserts. St Helena is a subtropical, volcanic, mid-Atlantic island between Africa and S. America, which is geologically old (c. 15 million years) and quite isolated, with Ascension Island at c. 1000 km to the North and the Kerguelen islands somewhat further away to the South. The island has suffered a lot from human impact over the past centuries.

While environmental impact assessment studies for the building of an airport were carried out in the Prosperous Bay Plain (PBP) area, it was noted by taxonomists of different disciplines, including entomologists (P. & M. Ashmole 2004) that lichens were prominent in many places, to the extent of forming the dominant flora. It turned out that the lichen flora of the island is very incompletely known, although some endemic species were known to be described from the threatened semi-desert zone on the island. Therefore, a detailed lichen survey of the area under proposed development was carried out in October 2006 and the results were compared to other parts of the island and to surrounding regions. The current knowledge of St Helena lichens has been reviewed in the process.

## 2 Material and Methods

A detailed survey of the literature and relevant internet sites and databases was carried out. Over 250, mostly unpublished collections from St Helena, including types of some purported endemics, as well as 250 collections from Ascension Island and 100 from Kerguelen were studied at the Natural History Museum, London. Field work was carried out by the author in October 2006 on St Helena and Ascension. The whole area of Prosperous Bay Plain, the proposed quarry site and the whole alignment of the proposed haul and access road have been scrutinized, as well as many selected areas in the dry zones of St Helena, some agricultural places and the (few) upland areas. The locations of survey areas is shown in Table 1 in the Appendix.

On Ascension Island, all different habitats have been scrutinized. Many identifications were made in the field, but selected samples have been collected together with the lava substrate by hammer and chisel. Most collections have been identified (with the exception of incomplete materials and the problematic genus *Usnea*) and labelled and will be preserved at the Adviesbureau voor Bryologie en Lichenologie herbarium and in the Natural History Museum (London) with some duplicates to be returned to St Helena. Specimens were studied in the field with a hand lens and with chemical reactions (KOH and Chlorine) to recognize genetic strains in morphologically similar taxa. Collected specimens were studied by dissecting and compound microscopes, with UV light and with Thin Layer Chromatography using toluene, dioxane & acetic acid as solvent. In the field and at a lecture organized by the National Trust, training about lichens has been given to local botanists/naturalists and a school class.



## 3 Literature Reports

There exists only one, very old, publication that is devoted to the lichens of St Helena (Leighton 1869). It cites 40 lichen taxa, half of which are highly unlikely records and probably misidentifications. Internet sites like the checklist of St Helena lichens do not add anything to this. Most interestingly, three of the species (*Lecanora personata*, *Lecidea approximans* and *L. lactescens*) are described as new to science from St Helena in this old paper. None seem to have been mentioned since from other areas in the literature, or have been reported to be synonymous with taxa from outside the island, although they all have been reclassified in other genera (as *Aspicilia personata*, *Buellia approximans* and *Blastenia* or *Huea lactescens*).

Lichens from St Helena are mentioned scattered throughout several other publications, sometimes just repeats of the Leighton data, but also additional ones, including several that are described new to science from the island. Müller (1893) described the additional endemic *Lecanora sanctae-helenae*, which is still accepted in a current monograph (Dickhäuser et al. 1995), and was still only known from St Helena.

Dodge (1959, 1971) is the most proficient if not the most reliable source, describing three species new to science. One (*Parmelia*, now *Parmotrema mellissii*) subsequently turned out to be widespread in the tropics, another one (*Parmelia sanctae-helenae*) is a synonym of the common *Rimelia reticulata* (Hale & Fletcher 1990), but the last one (*Parmelia*, now *Xanthoparmelia wildeae*) is still accepted in a recent monograph (Hale 1990) and is furthermore only known from South America. Interestingly, only one of the *Ramalina* species was correctly reported from St Helena (Krog 1994), and this is the non-endemic *R. arabum*, which was reported under another name (*R. rubrotincta*) from Ascension.

Very few reports of St Helena lichens were encountered in the monographs consulted while identifying the material, the only notable exception being a record of *Parmelinopsis spumosa* (as *Parmelina spumosa*) by Hale (1976).

An evaluation of all literature reports, usually based on the examination of specimens, is given in Table 2 in the Appendix. Interestingly, five species seem to have vanished since 1811 (Table 3), probably all species from high elevation open areas, which are now extensively covered by the introduced New Zealand Flax (*Phormium*).

## 4 Previously Collected Materials

From an evaluation of the literature it soon became apparent that nearly all lichens ever collected on St Helena are currently held in Natural History Museum, London. This includes most of the 19th Century records cited to be at Kew. An internet search of herbaria databases did not reveal any other major collection of materials, and the most substantial one was on loan to London anyway. Therefore, in September 2006, a visit was made to Natural History Museum in London, where over 250 lichen specimens from St Helena could be studied, including the type specimens of the purported endemics, but also recent, unpublished collections, e.g. from Cronk, collected in 1987 and from Balfe collected as recently as 2002. Among the materials were also collections from the Prosperous Bay Plain, collected by the entomologist Beattie.

Not all specimens recorded in the literature could be found, but specimens representing nearly all different taxa were found among the collections. The macroscopic, microscopic and chemical study of the specimens allowed an identification and evaluation of virtually all literature reports, as given in Table 2.

## 5 Overview of the Lichen flora of the Atlantic Islands

The lichen flora of the Atlantic Islands is still rather little known, although the Canary and Cabo Verde Isles and Madeira are relatively well-studied. About 500 publications are cited in a bibliography and checklist of the lichens of Macaronesia by Hafellner (1995) and many have appeared since, most notably a recent checklist of Azores lichens (Rodrigues & Aptroot 2005).

Lichens are generally rather widespread in their distribution. For example, the lichen floras of the Alps, the Himalayas and the Rocky Mountains are for at least 50 % identical, while the fanerogams share virtually no species, although they are similar in generic composition. However, there are notable exceptions to this rule: endemic lichens are known from isolated tropical mountains, fog-induced lichen zones in coastal deserts (Namibia, N. Chile, Baja California) and Atlantic and some Pacific Islands (like Hawaii and the Galapagos).

The lichen flora of the Atlantic Islands is characterized by two main elements:

- a pan (sub) tropical element in the humid, usually upland (but in the Azores also wet lowland) parts. This element can contain endemics, mainly because much of the wet vegetation has been destroyed and comparable vegetations in mainland Europe and Africa have vanished, but it generally consists of widely distributed lichens.
- a dry Mediterranean to semi-desert element, which contains numerous endemics (restricted to Macaronesia or even an island group or tiny island) in a few taxonomic groups only.

Endemism is low in most taxonomic groups, but decidedly higher in some. In the Roccellaceae, a family which is mostly occurring in coastal regions and most abundant on islands and coastal deserts, a strictly endemic species (*Roccellina jamesii*) is known from Ascension (Tehler 1985), and even an endemic genus (*Combea*) from Namibia (for details, see lichen checklists on the web). In the Physciaceae, one striking endemic (*Dirinaria adscensionis*) has been described from Ascension, but two convincing endemics in an endemic genus (*Santessonia*) occur in the Namibian desert. In the Teloschistaceae, several endemics are known from Namibia, especially in the genus *Caloplaca*. The genus *Xanthoparmelia* (with also a St Helena endemic) has numerous endemic species in Namibia. Several lobate *Lecanora* species (belonging to subgenus *Placodium*) are known to be endemic to coastal deserts. But by far the richest in strict and regional endemism is the genus *Ramalina*. In total, 40 species are known from Macaronesia (not counting 10 additional, doubtful records), half of which are not known outside these islands. Some occur on most Atlantic Islands, others only on all or few of the islands of one archipelago. The most striking endemism is to be found on the small (much smaller than St Helena), mostly flat island of Porto Santo off Madeira: on the old volcanic cones, no less than six species of *Ramalina* occur, none of which have ever been found elsewhere. Incidentally, the degree and nature of lichen endemism on the Galapagos Islands and Hawaii, which shares the isolation, the lava rock and the presence of semi-deserts with fog, is very similar.

On St Helena, two elements with an above-average percentage of lichen endemism come together: the fact that it is one of the Atlantic Islands, and the fact that it has fog-induced lichen vegetation in semi-desert areas. The possibilities for local endemism are therefore high.

# 6 Lichen Flora and Vegetation of St Helena

## 6.1 Vegetation Zones

After the massive impact of man on St Helena, the present vegetation zones can be best characterized as follows (from mountain to the sea, modified after Cronk, 2000): tree fern thicket, agricultural zone, semi-desert, and coastal cliffs.

The North- and West-exposed coastal cliffs are nearly devoid of lichens, up to an altitude of c. 200 m. The same phenomenon has been reported from Ascension (Tehler 1985). It is probably generally too dry, as fog apparently begins at higher elevations. However, the southern and easterly exposed coastal cliffs are very rich in lichens.

The agricultural zone consists of the area with plantations, most of the housing, scrubs, hedges etc. Lichens occur here and there, especially on roadside *Erythrina* trees and branches, wood and boulders. In general, the species are subtropical (to tropical or temperate) and widespread elsewhere. From a random sample collection of lichens from this zone, it would not be possible to determine from which country, and not even from which continent they would have originated.

The tree fern thicket contains the remnants of the original forest, and most of the endangered endemic plants and trees occur here. The lichen flora is essentially that of tropical mountains, and resembles that of the Green Mountains on Ascension, but equally that of mountains in Brazil (e.g. Carassa) or Uruguay, but of course much poorer in species, undoubtedly due to the small size of the forested area and the very wet conditions, which are better suited to mosses and ferns.

The semi-desert is the area of the main lichen interest, not only for this project, but also for the whole island of St Helena. Lichens are present in most places, and often abundant. Within the zone three main lichen vegetation types can be distinguished:

- soil crusts
- boulder fields
- vertical cliffs.

The vegetation of the vertical cliffs is the richest in abundance, but not necessary in diversity. The boulder fields are the richest in diversity, as there are soft sandy patches between with soil crusts. The soil crusts occur also alone, on some of the sandy desert areas, often with a low diversity.

Special additional habitats with each a few extra or characteristic species are:

- overhanging cliffs
- ledges with run-off along gullies
- shrubs.

All endemic lichens from St Helena are known from the semi-desert zone and they are dominant in most places. They are treated in detail below.

The collecting localities are described and illustrated in the Appendix (Table 1). In Tables 2 and 4 lists of the lichen vegetation on selected places on St Helena and Ascension Island are given, as examples of the various lichen communities. Additional species identified in the material from St Helena are given in the last column. All species without pertinent literature reports in Table 2 are new reports for the island, for Africa or even for the Southern Hemisphere as indicated.

## 6.2 Endemics

In many places, endemic lichens are the dominant native organisms on St Helena. Unlike in mosses (Wigginton 2006) and especially fanerogams and many animal groups, there are no invasive lichens, and none are to be expected in future. Lichens tend to grow on substrates that are usually devoid of other organisms, and the vast majority of the species disperse with very tiny spores that essentially eventually reach each suitable habitat, in which they then establish themselves spontaneously.

Dramatic changes in lichen flora and vegetation are invariably attributable to changes in the habitat, be it microclimatic conditions, global warming or various sources of air pollution. Actually the endemic lichens detailed below are notable exceptions to this rule; apparently, they (and their relatives from other Atlantic Islands) lost the ability for long distance dispersal, meaning that their spores are apparently not viable, and that reproduction is vegetatively by fragmentation.

## 6.3 Distribution of the Endemic Lichen Species

The species described below are, from the current information available, considered to be endemic to St Helena.

*Dolichocarpus seawardii* Aptroot sp. nov. ined. is only the second species in the genus. The type is only known from Chile (Santesson 1949), where it grows on Cactus spines in a fog desert. The new species is smaller than the type, and grows on wet, overhanging rock ledges, secure from disturbance. It was found on the Barn and below Little Stone Top, where it forms large patches.

*Dermatiscum pusillum* Aptroot sp. nov. ined. is only the third species in this genus, which is only known from Africa. It differs from all other species in the genus by the small lobes and the greenish colour. It occurs on boulders and rock outcrops on Prosperous Bay Plain, but also elsewhere on St Helena (e.g. the Barn, Gregory's Battery). It is often quite sparse, but not of conservation concern.

*Dimelaena triseptata* Aptroot sp. nov. ined. is a member of a small genus (less than 10 species known), which is most diverse in arid regions of the Southern Hemisphere. It differs from all other species in the genus by the ochraceous colour and the three-septate, relatively large ascospores. It occurs on dusty plains and boulder fields on Prosperous Bay Plain and on the track of the proposed Airport Access road, but also elsewhere on St Helena (e.g. the Barn, Little and Great Stone Top). It is locally so common that it is not of conservation concern.

*Xanthoparmelia beccae* Aptroot sp. nov. ined. is a very unusual coralloid species that grows in dusty areas, where it can be the only species present. It also occurs in boulder fields areas intermixed with a rich lichen flora. It seems to be related to *X. eradicata* (Nyl.) Hale, which only occurs in the Cape Region of South Africa (Hale 1990). *X. beccae* occurs on dusty plains and boulder fields on Rupert (right on the track of the proposed Airport Access road, 70 meters from the Trig Point), but also elsewhere on St Helena (Bryan's Rock, the Barn, Great Stone Top). It is locally so common that it is not of conservation concern.

*Ramalina* species were found to be rather common on lava in the semi-desert. A detailed morphological and chemical study was carried out, and comparisons made with material and publications on published species from other regions in the world, as well as with extensive unpublished *Ramalina* material from Ascension, Hawaii and the Galapagos. The conclusion is that no less than four undescribed endemic *Ramalina* species occur on lava in the semi-desert of St Helena. All species seem to be quite well distributed and common. One was previously named in the herbarium already with the unpublished name *Ramalina sanctae-helenae*. The following taxa have been recognised:

- *Ramalina geniculatella* Aptroot sp. nov. ined. is characterized by a flattened, sparingly irregularly branched thallus with linear pseudocyphellae and laminal, solitary, large (c. 1-2

mm) apothecia. The thallus is markedly geniculate (bent) at an apothecium insertion. The chemistry is boninic and protocetraric acids. There is no close relative identified outside St Helena, but this species may be close to the boninic acid containing *Ramalina sanctae-helenae*. It occurs on boulders and cliffs in the Prosperous Bay Plain and almost everywhere elsewhere on the island. It is locally so common that it is not of conservation concern; the incorrect Leighton record of *Ramalina ceruchis* may have been this species.

- *Ramalina ketner-oostrae* Aptroot sp. nov. ined. is characterized by a flattened, attenuating, often contorted, sparingly irregularly branched thallus without pseudocyphellae and laminal, solitary, large (c. 1-2 mm) apothecia. The chemistry is norstictic acid. There is no close relative identified outside St Helena, but this species may be close to *Ramalina sanctae-helenae*. It occurs only on cliffs in the Prosperous Bay Plain and elsewhere on the island. It is locally so common that it is not of conservation concern.
- *Ramalina rigidella* Aptroot sp. nov. ined. is characterized by an angular, richly irregularly branched thallus with linear pseudocyphellae-like lines and lateral to terminal tiny schizidioid soredia. Apothecia are not known. The chemistry is norstictic and connorstictic acids. There is no close relative identified outside St Helena, but this species may be close to *Ramalina ketner-oostrae*. It occurs on boulders and cliffs in the Prosperous Bay Plain and almost everywhere elsewhere on the island. It is locally so common that it is not of conservation concern. It even occurs on walls of High Knoll Fort. Judging from the size of the specimens on the 150 yr old walls of High Knoll Fort (25 cm) and the largest specimens seen (on the Barn, 80 cm), individual specimens can reach an age of several centuries, probably about 500 yr.
- *Ramalina sanctae-helenae* Aptroot sp. nov. ined. is characterized by a flattened, sparingly to richly antler-like branched thallus with linear pseudocyphellae-like lines and often numerous, small (c. 0.5 mm) laminal apothecia. The thallus is not geniculate (bent) at an apothecium insertion. The chemistry is variable: two different genetic strains have been identified, each characterized by the secondary metabolites, as follows: I. boninic and protocetraric acids, II. no substances (even in fresh, well-developed specimens). There is no close relative identified outside St Helena, but this species may be close to two other endemic *Ramalina* species of St Helena, as it shares several morphological trends, and the boninic acid-strain shares the chemistry with *Ramalina geniculatella*. The species is known from all over the semi-desert area and cliffs; the incorrect Leighton record of *Ramalina scopulorum* should have been identified as this species.

The presence of various genetic strains is not uncommon in a lichen species, but certainly indicates that the species is evolutionary old, as it is on the verge of speciating into several (sub)species. The fact that some other endemic *Ramalina* species from St Helena seem most closely related to this already old complex species, suggests that speciation of endemic *Ramalina* on St Helena has been going on even for a longer time, probably for most of the 15 MA the island is in existence, and most probably after an initial arrival of a precursor species from Macaronesia.

The endemic *Ramalina* species complex in St Helena, with four species and one additional “sub-species” is not of immediate conservation concern, as these taxa are surprisingly common and widespread on the island, even though they have apparently not been able to disperse elsewhere and are unlikely to do so in the near future.

Apparently, the endemic St Helena *Ramalina* species (and their relatives from other Atlantic Islands) lost the ability for long distance dispersal, meaning that their spores are apparently not viable, and that reproduction is vegetatively by fragmentation. This means that probably few different genotypes are present and most populations will be clones, originating from one individual thallus, possibly dating back many thousands or even million years go.

## 6.4

### Non-endemic Lichen Species Described Originally from St. Helena

*Lecanora personata* was described by Leighton (1869) and subsequently named *Aspicilia personata* by Dodge (1971). The type and additional material was examined, and found to have a *Lecidella*-type of excipulum colouration (mottled green), a pale brown hypothecium, an

epihymenium with black granules and a chemistry of arthothelin and thuringione. It is therefore identified as a synonym of *Lecidella buelliastrum* (Müll. Arg.) Knoph & Rambold, known from South America and Australia (Knoph 1990). It occurs on the Prosperous Bay Plain and almost everywhere elsewhere on the island. It is locally so common that it is not of conservation concern.

*Lecanora sanctae-helenae* Müll. Arg. was described by Müller (1893) and is still accepted in a current monograph (Dickhäuser et al. 1995), and was still only known from St Helena. It covers large areas of rock with a white thallus with whitish, irregularly rounded, pruinose apothecia. It occurs on the Prosperous Bay Plain and almost everywhere elsewhere on the island. It is locally so common that it is not of conservation concern. Surprisingly, it was also found on Ascension Island, where it is locally common as well.

*Lecidea approximans* was described as new to science from St Helena by Leighton (1869). It was reclassified as *Buellia approximans* by Zahlbruckner in a catalogue, and mentioned as such also by Dodge (1971). The type is very fragmentary, but a further original specimen (called an isotype) is present on the same piece of rock that contains the type of *L. lactescens*. Judging from the yellowish, C+orange thallus and the beautiful illustrations and description by Leighton, it is a new synonym of *Buellia halonia* (Ach.) Tuck., known from coastal rock in South Africa and America (Scheidegger & Ruef 1988). It occurs on the Prosperous Bay Plain and almost everywhere elsewhere on the island. It is locally so common that it is not of conservation concern.

*Lecidea lactescens* was described as new to science from St Helena by Leighton (1869). It was reclassified as *Blastenia lactescens* Zahlbruckner in a catalogue, and as *Huea lactescens* by Dodge (1971). Currently, neither the genus *Blastenia* nor *Huea* are in use any more. The type (studied in the Natural History Museum in London) is tiny, and could not be studied non-destructively. It is quite likely that this is in fact a synonym of *Lecidella chodati* (Samp.) Knoph & Leuckert, known from Portugal, South Africa, Australia, New Zealand and Juan Fernandez (Knoph 1990). It occurs on the Prosperous Bay Plain and almost everywhere elsewhere on the island. It is locally so common that it is not of conservation concern. It was also found on Ascension.

*Parmelia mellissii* was described by Dodge (1959). It subsequently turned out to be widespread in the tropics, and is now known as *Parmotrema mellissii* (Dodge) Hale.

*Parmelia sanctae-helenae* was described by Dodge (1959). It is a synonym of the common and cosmopolitan *Rimelia reticulata* (fide Hale & Fletcher 1990).

*Parmelia wildeae* was described by Dodge (1959). It is now called *Xanthoparmelia wildeae* (Dodge) Hale and is still accepted in a recent monograph (Hale 1990). There was however some doubt whether the original material really comes from St Helena, as the collector, Wilde, is not mentioned in a list of botanical collectors on St Helena by Cronk (2000). However, the species was eventually re-found on St Helena. It occurs on dusty plains and boulder fields on Rupert (North of the track of the proposed Airport Access road), but also elsewhere on St Helena (Bryan's Rock, Great Stone Top). Apart from St Helena, it has been reported from several countries in South America by Nash et al. (1995).

## 6.5 Mapping of the Lichen Communities in Prosperous Bay Plain and on the Track of the Access Road Alignment.

The whole area of the proposed airport building site and its surroundings have been investigated for lichens. The lichen communities were mapped to show the following characteristic habitat types and categories of lichen cover:

- soil crusts
- boulder fields
- vertical cliffs
- sand without lichens

Figure 1 gives the approximate distribution of the vegetation types within the investigated area.

The following collecting localities with their species lists give examples of the species composition of these communities though they are by no means the only areas visited:

- soil crusts: loc. 2 and 4
- boulder fields : loc. 1, 3 and 5
- vertical cliffs: loc. 6, 7 and 8

On the track of the access road, the locations 9, 10, 11 and 12 were investigated (see Figure 2). Localities 9-11 are vertical cliffs, while locality 12 is mostly soil crusts. Most of the remaining route of the access road cut through areas without lichens, such as grasslands.

For comparison, numerous localities were visited outside the affected area. Figure 3 shows the remaining localities visited. As can be seen from the species lists in Table 2, virtually all lichen species have been found also outside the affected areas. The only exceptions seem to be two *Pyxine* species, which were found only at the proposed quarry site. Both are however widely distributed species.



## 7 Comparison with Surrounding Regions

The lichen flora of upland St Helena consists mainly of rather general pantropical weeds, but that of the semi-deserts shows some relationships with Ascension and Cabo Verde. For instance, *Ramalina maderensis* (a saxicolous species with barbatic and obtusatic acids) is known (and only known) from all archipelagos in Macaronesia, including Cabo Verde. *Ramalina arabum* (on St Helena both corticolous and saxicolous) is known from Cabo Verde (where it is mostly saxicolous), Ascension, South Africa and Madagascar. *Lecidella chodatii* is currently known from Portugal, South Africa, Australia, New Zealand and Juan Fernandez; occurrence on some Atlantic Islands between Portugal and St Helena is also quite likely. *Roccella montagnei* on the other hand is at its most northern locality in the Atlantic Ocean; it is known from S. and E. Africa, where it often abundant in coastal areas, and Asia, where it is e.g. common in India, and Oceania, but not from Europe or Macaronesia.

The lichen floras of the surrounding regions in all directions from St Helena have been scrutinized in order to evaluate the hypothesis that the supposed St Helena endemics listed above in Section 6.3 do not occur elsewhere.

The lichens from Brazil and Uruguay to the West are quite well known, especially those in the coastal regions, where much research has been carried out. There are no similarities with the semi-desert lichen flora of St Helena, and no supposed endemic species in common. While there are strong similarities between the lichen flora of upland St Helena and upland Brazil and Uruguay, where the St Helena representation is, of course, only a fraction of those of Brazil and Uruguay, these concern mostly pantropical species.

The lichens from the Tristan da Cunha archipelago to the South are moderately well known. They share also the upland element, which is on the Tristan da Cunha even less developed, as trees are even rarer here. In addition, Tristan da Cunha has a large element of temperate to sub-Antarctic lichens, with many *Parmeliaceae*, *Cladonia*, *Placopsis* and *Stereocaulon* species.

The lichen flora of Namibia and adjacent South Africa to the east is fairly well known. The lichen flora seems to be related to the semi-desert areas on St Helena, but the congruence is at most only at the generic level. Most species are different, and the Namibian lichens are for a large proportion strict endemics. An obvious difference is that *Ramalina* species (an Atlantic element) are absent from Namibia.

The lichen flora of the closest neighbour of St Helena, Ascension Island, to the north, is still poorly documented. Only a few 19th Century publications are devoted to it, and they cite mostly the same specimens, in total about 35 species. This includes the description of the endemic *Dirinaria adscensionis*, which however is probably just be a richly fruiting morph of *D. flava*. A more convincing endemic species (*Roccellina jamesii*) has since been described from Ascension (Tehler 1985) in a paper with a few additional records. It was now found to be common on St Helena as well. Two methods were employed to augment this:

- in the Natural History Museum in London a large collection of lichens, collected in 1987 by the lichenologist P.W. James is present, but largely still unprocessed. Over 250 specimens of this collection have been examined, mainly concentrating on taxa known to or likely to occur on St Helena. All specimens of the genus *Ramalina*, which is so rich in endemics on St Helena, were examined closely and tested chemically. Surprisingly, none of the St Helena endemics turned up in the material. An explanation may well be that Ascension island is geologically much younger, only about 1.5 million years. The only *Ramalina* species the two islands have in common are four rather widespread species, viz. *R. arabum* (which was previously reported from Ascension under the name *R. rubrotincta*), *R. lacera*, *R. nervulosa* and *R. peruviana*. Ascension seems not to have endemic *Ramalina* species, as all species identified are widespread.

- In October 2006, lichen fieldwork was carried out by the author on Ascension. Nearly all localities suitable for lichen growth were investigated. In total about 100 species were encountered (Table 2), most of which were common also to St Helena. The general aspect is that of a poor representation of the St Helena lichen flora, with only two species that only occur on both these islands and so far known nowhere else: *Lecanora sanctae-helenae* and *Rocellina jamesii*.

## 8 Impact of Proposed Airport

For the building of an airport a substantial area will have to be levelled and graded, a quarry established, and a haul and access road needs to be built to the sea landing facility at Rupert's Bay. According to the current plans, this will result in the loss of several areas rich in endemic lichens. The key areas are considered below:

- Prosperous Bay Plain is literally covered with lichens, which are the most abundant native organisms in the area. The lichens are at their most diverse in the boulder fields, forming the most common vegetation in the area. Most endemic lichens occur abundantly in at least two vegetation types: the *Dermaticum* and *Ramalina* species on the boulder fields and on the vertical basalt cliffs; the *Dimelaena* and *Xanthoparmelia* species on the boulder fields and the soil crust areas.
- The airport and the associated infrastructure (runway, taxiway, land fill at Dry Gut, terminal, fire station, access road, quarry site, wharf etc.) as they are currently planned are for the most part situated in relatively lichen-poor sites, including some areas that are devoid of lichens. Only one vertical basalt cliff (the North slope of Dry Gut, locality 8 on Figure 1) will be lost to the infilling of Dry Gut, while there are many similar sites in the locality that will remain intact. None of the soil crust-dominated areas will be directly threatened by the airport although one (locality 12 on Figure 2) is under threat by the access road (see below).
- The most sensitive area in Prosperous Bay Plain is one of the two areas dominated with soil crusts (locality 2 on Figure 1). It is full of the endemic *Dimelaena triseptate* and the rare but not endemic *Xanthoparmelia phaeophana*. It lies outside the runway and could easily be left intact. It is however fragile as the soil is very soft and dusty. This area should be protected with fencing throughout the whole construction period in order to avoid accidental damage. After the airport has been constructed, a sign could be erected providing information about this special environment.
- The land fill in the Gill Point Waterfall gully at the South end of the runway will not seriously threaten any special lichens, as long as the track upstream of the fill (locality 6 on Figure 1), where some special species occur (e.g. *Psorotichia cf schaeferi*), will be left intact.
- The exact location of the quarry site near Rupert's was not known at the time of study. The locality investigated (locality 11 on Figure 2) stands out as the richest lichen site in the valley and it is therefore advisable to quarry a different site in the same area.
- Great Stone Top is unique in that it harbours several non-endemic lichen species (e.g. *Dirinaria flava* and *Usnea exasperata*) for which this is the only known locality on St Helena. There is a remote lighting planned at its top, where these species occur. However, the species occur also on the nearly vertical seaward slope, which will not be affected.
- The soil crust vegetation along the Pipe Path on Rupert's Hill is unique in that it contains the largest known population of *Xanthoparmelia wildeae* and a beautiful (but probably fairly recent) population of the endemic *Xanthoparmelia beccae*. The former is situated just north-east of the road alignment as it is currently proposed, the latter is on the line of the proposed road, 70 metres east of the Trig. point along the ridge. If the road were to follow the ridge, the localities of both species would become endangered.
- In the absence of mitigation, however, no endemic (or other) lichens will become extinct or much reduced in area on St Helena, as all occur also in areas unaffected by the present development.

# 9 Mitigation

## 9.1 Protection of Prosperous Bay Plain

The need for strict protection of Prosperous Bay Plain has been noted above. The area should be protected from incursion by both construction vehicles and by unmanaged access by the public, by the instalment of suitable fencing.

## 9.2 Haul/Access Road Alignment

The most sensitive communities are the areas dominated by soil crusts. One beautiful (but probably fairly recent) population of the endemic *Xanthoparmelia beccae* (the population from which this new species to science will be described) is directly threatened if the access road is going to follow the ridge along the Pipe Path on Rupert's Hill. The population is situated on the alignment of the proposed road, 70 metres east of the Trig. point along the ridge (locality 12 on Figure 2; the GPS coordinates of locality 12 in the appendix, Table 1, apply to this population). The population could be saved by moving the road slightly downward along the slope south of the Trig. point. Here, the lichen flora is poor. The relocation of the road will also secure protection of the small but rare population of the endemic *Commidendrum rugosum* trees just North of the Trig point. Alternatively, the lichens can be moved to nearby areas with a similar soil, by picking up the thalli and simply placing them on the soil surface. This can be done within one day and should be done by somebody who can recognize the species (see the Figure 1 at locality 12 in the Appendix).

Loss of lichen communities in Dry Gut to the placement of fill and construction of the runway extension embankment could be reduced by the adoption of a bridge structure to support the runway, as has been done on the island of Madeira. This option, however, has been examined by DFID's consultants and was rejected for reasons of excessive cost.

## 9.3 Future Management

The building of an airport will also have long-term indirect effects on the lichen vegetation, of the following kinds:

- lichens are generally very sensitive to air pollution, and the pollution from aircraft may have a deleterious effect, at least in a narrow zone around the airport. Therefore, a slight diminuation of lichen growth in a zone around the airport due to air pollution is to be expected. However, the number of aircraft movements over the long term are likely to be low to moderate and the levels of air pollution are very low otherwise. Effects of air pollution of much larger airports on lichens growth has been demonstrated in the past, but is not generally very large. In any case, the effects should be monitored on a regular basis (e.g. once every 2 years), taking the present survey data as the baseline. This monitoring work, to be carried out by an ecologist specialised in deserts and trained in St Helena lichens, should logically be financed from the airport project budget, as it concerns side-effects of the project.
- the presence of an airport will undoubtedly bring in more people, possibly to a large extent eco-tourists. These tend to explore the islands they visit in great detail. They may cause trampling and especially removal of loose pebbles, deleterious both for lichens and arthropods. The removal of pebbles and rock substrate, although for other reasons, viz. house and road building, has probably been a major source of damage already to the

biodiversity of this sensitive ecosystem in the past.. This would militate for the strict protection of nature reserve areas without unmanaged public access, together with the placement of information panels explaining the vulnerable semi-desert ecosystem.

## 10 Future Monitoring

Lichens that are stressed or slowly dying off, will do so over one to several years, as they are poikilohydric organisms that only metabolize when moist, which under semi-desert conditions means rarely. In dry condition, the lichens are dormant. Therefore, the lichens should be monitored over a period of several years. It is difficult to judge whether a lichen is dying, and even when or if it is dead, but a discolouration is usually an early warning sign that something is amiss. Depending on the chemical composition of the species, a rusty red or a whitish discolouration can be expected. At the first signs of discolouration, the rocks should be removed to another, hopefully better, place. If pebbles with endemic *Ramalina* species are removed and placed in other localities with probably similar conditions as detailed before, one can never be entirely sure whether the relocation will be successful. Microclimatic conditions, which are nearly impossible to measure and moreover not known for the respective species, might be different at a critical level of stress, but given the wide variation of micro-habitats in which one species can usually be found, chances are that most will survive.

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# Appendix

**Table 1 Study Sites on St Helena and Ascension**  
Studied for lichens by A. Aptroot in Oct. 2006 (refer to Figures 1 to 3 for locations).

Area	Location
<b>Study sites on St Helena</b>	
1	Prosperous Bay Plain, on track of runway S of Trig Point. Slope with boulders and soil crusts. 15°56.923'S, 5°39.019'W(Astro DOS 71/4) alt. 325 m.
2	Prosperous Bay Plain, near begin of Signal House track. Soft lava dust with soil crusts. 15°56.891'S, 5°38.972'W (Astro DOS 71/4) 144 alt. 330 m.
3	Prosperous Bay Plain, on track of access road N of Bone Gully. Slope with boulders and soil crusts. 15°57.067'S, 5°39.596'W(Astro DOS 71/4) alt. 330 m.
4	Prosperous Bay Plain, Bone Gully. Soft lava dust with soil crusts. 15°57.269'S, 5°39.704'W(Astro DOS 71/4) alt. 350 m.
5	Prosperous Bay Plain, S of Widow Slope. Slope with boulders and soil crusts. 15°57.461'S, 5°39.450'W(Astro DOS 71/4) alt. 325 m.
6	Prosperous Bay Plain, Dry Gut upstream of proposed fill. Smooth basalt slope, occasionally wet. 15°57.610'S, 5°39.281'W(Astro DOS 71/4) alt. 325 m.
7	Prosperous Bay Plain, Dry Gut at proposed fill. Overhanging basalt cliffs. 15°57.706'S, 5°39.240'W(Astro DOS 71/4) alt. 325 m.
8	Prosperous Bay Plain, N slope of Dry Gut on track of runway at proposed fill. Vertical basalt cliff. 15°57.641'S, 5°39.080'W(Astro DOS 71/4) alt. 280 m.
9	Rupert's Village, lower slopes behind farm. Slope with boulders and soil crusts. 15°55.010'S, 5°42.962'W(Astro DOS 71/4) alt. 40 m.
10	Rupert's Valley, lower slopes at begin of ascent of haul road. Vertical basalt cliff. 15°55.547'S, 5°42.436'W(Astro DOS 71/4) alt. 100 m.
11	Rupert's Valley, lower slopes at proposed quarry site. Slope with boulders and soil crusts. 15°55.769'S, 5°42.191'W(Astro DOS 71/4) alt. 110 m.
12	Rupert's Hill, along Pipe Path. Slope with boulders and soil crusts. 15°55.011'S, 5°42.098'W(Astro DOS 71/4) alt. 425 m.
13	Bryan's Rock. Slope with boulders and soil crusts. 15°55.968'S, 5°39.633'W(Astro DOS 71/4) alt. 400 m.
14	S of Gregory's Battery. Vertical basalt cliff. 15°55.800'S, 5°39.966'W(Astro DOS 71/4) alt. 300 m.
15	Bradleys, N of Government Garage. Slope with boulders and soil crusts. 15°56.651'S, 5°39.572'W(Astro DOS 71/4) alt. 350 m.
16	Above Jamestown, along track to Saddle Battery. Vertical basalt cliff. 15°55.744'S, 5°42.817'W(Astro DOS 71/4) alt. 250 m.
17	The Barn, along God's Path. Vertical basalt cliffs and slope with boulders and soil crusts. 15°54.929'S, 5°40.428'W(Astro DOS 71/4) alt. 475 m.

Area	Location
18	The Haystack. Vertical basalt cliffs and slope with boulders and soil crusts. 15°54.880'S, 5°39.829'W(Astro DOS 71/4) alt. 600 m.
19	Hutts Gate, along road. Trees and road walls. 15°57.353'S, 5°42.246'W(Astro DOS 71/4) alt. 650 m.
20	High Peak. Basalt cliff with trees. 15°58.495'S, 5°44.371'W(Astro DOS 71/4) alt. 700-750 m.
21	Peak Dale, near Old Luffkins. Slope with large basalt boulders and trees. 15°59.422'S, 5°44.719'W(Astro DOS 71/4) alt. 600-700 m.
22	Diana's Peak. Slope with tree ferns and basalt cliff. 15°57.7'S, 5°42.4'W(Astro DOS 71/4) alt. 800 m.
23	S of Boxwood Hill. Slope with trees. 15°58.6'S, 5°40.2'W(Astro DOS 71/4) alt. 375 m.
24	S. of Little Stone Top. Slope with large basalt boulders and soil crusts. 15°58.507'S, 5°40.038'W(Astro DOS 71/4) alt. 375 m.
25	Great Stone Top. Slope with basalt boulders and soil crusts and vertical basalt cliff. 15°58.530'S, 5°39.672'W(Astro DOS 71/4) alt. 400-480 m.
26	Fisher's Valley, near waterfall. Vertical basalt cliff. 15°57.007'S, 5°39.495'W(Astro DOS 71/4) alt. 300 m.
27	Longwood, near church. Roadside trees. 15°56.695'S, 5°41.380'W(Astro DOS 71/4) alt. 490 m.
28	Mount Pleasant. Garden. 15°58.202'S, 5°43.197'W(Astro DOS 71/4) alt. 600 m.
29	High Knoll Fort. On fortress walls. 15°56.370'S, 5°43.288'W(Astro DOS 71/4) alt. 600 m.
30	St Paul's Cathedral. Churchyard. 15°57.096'S, 5°43.460'W(Astro DOS 71/4) alt. 600 m.
<b>Study sites on Ascension Island</b>	
31	Georgetown, Longbeach, coastal lava field. 7°55.4'S, 14°24.3'W alt. 5 m.
32	S. of Georgetown near crossroads. Lava field. 7°56.413'S, 14°24.660'W alt. 30 m.
33	W. of Two Boat Village. Lava field on slope with large basalt boulders and soil crusts. 7°56.181'S, 14°22.520'W alt. 175 m.
34	E. slope of Sisters Peak. Lava field on slope with large basalt boulders and soil crusts. 7°55.977'S, 14°21.971'W alt. 275 m.
35	Lady Hill. Lava field on slope with large basalt boulders and soil crusts. 7°56.637'S, 14°22.880'W alt. 300 m.
36	Top of Sisters Peak. Lava field on slope with large basalt boulders, shrubs and soil crusts. 7°55.580'S, 14°22.311'W alt. 350-450 m.
37	Green Mountain, around Cottage. Forest with basalt cliffs and soil crusts. 7°57.5'S, 14°21'W alt. 750-800 m.
38	Cricket Valley. Basalt cliffs with trees and soil crusts. 7°56.859'S, 14°19.581'W alt. 137-400 m.

**Table 2 Lichens on St Helena**

**Key:**

x = on rock and/or soil

c = on tree and/or wood

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
Acarospora citrina														x														pantropical	island			
Acarospora impressula				x	x	x										x	x									x		cosmopolitan	island			
Agonimia pacifica																									x			pantropical	Africa			
Agonimia papillata																												pantropical	Africa			
Amandinea lecideina	x		x		x			x	x	x	x		x	x	x	x	x	x										cosmopolitan	island			
Amandinea submontana												c																Africa & S. America	island			
Anisomeridium distans																										x		N. America	S. Hemisphere			

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
Arthonia antillarum																			c									pantropical	island			
Arthonia cf complanata																			c									pantropical	ID uncertain			
Aspicilia contorta			x	x	x			x			x	x	x	x			x	x						x				cosmopolitan	island			
Bacidia laurocerasi																			c									cosmopolitan	island			
Bacidia medialis																			c									pantropical	island			
Brigantiaea leucoxantha																			c	c	c							pantropical	island			
Buellia aethalea																x												cosmopolitan	island			
Buellia halonia	x		x				x	x	x	x	x	x		x	x	x	x	x						x	x			Africa & America	island	Leighton, Dodge V	Lecidea, Buellia approximans	new synonym
Buellia mamillana																x												America	Africa			
Buellia stellulata											x	x																cosmopolitan	island			
Buellia subaethalea												x						x	x									America	Africa			

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
Buellia subalbula								x																	x		pantropical	island				
Buellia tessarata	x		x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x							pantropical	island			
Bulbothrix decurtata																									x		Africa	island				
Byssoloma leucophthalmum																											pantropical	island				
Byssoloma subdiscordans																				c	c						pantropical	island				
Caloplaca cf bolacina	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	America	ID uncertain	Leighton	Lecanora aurantiaca var. erythrella	wrong ID	
Caloplaca crenularia					x			x	x	x		x	x	x			x	x							x	x	Europe & Macaronesia	S. Hemisphere				
Caloplaca cf dalmatica	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x			x					x	x	Europe	ID uncertain				
Caloplaca flavocitrina				c	xc			x	x	x		x	c	x	x	x	x			x	xc	x		x			Europe & Macaronesia	S. Hemisphere				
Caloplaca flavovirescens	x		x	x		x		x	x	x	x				x	x	x	x			x	xc	x		x	x	cosmopolitan	island				
Caloplaca haematodes					x	x		x	x	x	x		x	x			x	x							x		Africa	island				

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
Caloplaca cf holocarpa																x												cosmopolitan	ID uncertain			
Caloplaca cf sublobulata																x												Australia & Africa	ID uncertain			
Candelaria concolor			x	x	x			x	x	x						x			x						x	x		cosmopolitan	island			
Candelariella efflorescens					x				x																x			N. America	S. Hemisphere			
Catillaria chalybeia																									x			cosmopolitan	island			
Catillaria nigroisidiata					x						x					x										x		W. Europe	S. Hemisphere			
Chrysothrix xanthina	x		x	x	x			x	x	x		xc	x	x		x	x	x	xc	xc	xc	x			x	x		pantropical	island	Leighton	Lepraria flava	wrong ID
Cladonia dactylota												x																America	Africa			
Cladonia nana																												pantropical	island			
Cladonia ramulosa																												cosmopolitan		Leighton	Cladonia pityrea	synonym
Cladonia subpityrea												x																pantropical	island			

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25						
Cladonia subradiata											x						x	x	c	xc	x	xc		x			pantropical	island			
Coccocarpia palmicola									x		x						x	x	c	xc	xc	xc		x			pantropical	island			
Collema cf coccophorum				x						x			x														cosmopolitan	ID uncertain			
Dermatisium pusillum sp. nov.				x		x		x									x										endemic	science			
Dibaeis soreliata																				x			x				pantropical	island			
Dimelaena radiata	x	x	x		x							x				x											Europe, America & Macaronesia	island			
Dimelaena triseptata sp. nov.		x		x	x						x		x				x								x	x	endemic	science			
Diploicia canescens			x													x	x									x	cosmopolitan	island			
Diploschistes caesioplumbeus			x	x	x	x				x	x					x	x							x	x		cosmopolitan	island			
Diploschistes euganeus																											Europe, Africa	island			
Diploschistes muscorum										x	x	x					x	x	x						x		cosmopolitan	island			

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
<i>Diploschistes prominens</i>																x	x								x		Europe, Macaronesia	S. Hemisphere				
<i>Dirina insulana</i> s.s.						x		x	x	x	x		x	x	x	x	x	x				x			x	x		Ascension, Madeira	island			
<i>Dirina insulana</i> f. <i>soralifera</i>						x		x						x		x												Ascension, Madeira	island			
<i>Dirinaria applanata</i>			x	x	x					x	x	x	x	x	x	x	x	x							x	x		pantropical	island			
<i>Dirinaria flava</i>																										x		Africa	island			
<i>Dirinaria picta</i>								x												c		xc			x			pantropical		Leighton	<i>Physcia picta</i>	synonym
<i>Dolichocarpus seawardi</i> sp. nov.																									x			endemic	science			
<i>Endocarpon pallidum</i>				x		x			x								x											cosmopolitan	island			
<i>Endocarpon pusillum</i>	x		x	x	x								x	x	x	x									x	x		cosmopolitan	island			
<i>Enterographa anguinella</i>							x	x																		x		pantropical	island			
<i>Enterographa multilocularis</i>																												S. America	Africa			



Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25									
Erioderma solediatum																	x	x		c		c								pantropical		Leighton, Arvidsson & James	Erioderma unguigerum	partly wrong ID
Eugeniella sp.																						c								id uncertain	ID uncertain			
Euopsis pulvinata					x	x							x			x	x										x			cosmopolitan	island			
Fellhanera bouteillei																					c	c	c							cosmopolitan	island			
Fellhanera cf montana																					c									S. America	ID uncertain			
Fissurina cf inquinata																					c									pantropical	ID uncertain			
Fissurina sp.																					x	x								id uncertain	ID uncertain			
Flavoparmelia soledians	x				x								x	x	x	x	x	x									x			cosmopolitan	island			
Flavopunctelia flaventior																														cosmopolitan	island			
Gassicurtia acidobaeomyceta																														Africa & America	island			
Graphis cf assimilis																														pantropical	ID uncertain			

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25						
Graphis crebra																					c						pantropical	island			
Graphis elegans																				c							cosmopolitan	island			
Graphis furcata											c															pantropical	island				
Graphis marginata																			c							pantropical	island				
Haematomma fenizianum			x		x			x	x	x	x	x		x	x	x	x	x		x	x	x	c	x	x	pantropical	island, trees				
Hafellia leptoclinoides							x																			Europe, Macaronesia	island				
Heppia lutosa				x	x											x										cosmopolitan	island				
Heterodermia circinalis																		x		x	c	c				America	Africa				
Heterodermia galactophylla																		x		xc	xc	c				pantropical	island				
Heterodermia isidiophora																			c	c	xc					pantropical	island				
Heterodermia leucomela																			c	c						pantropical		Leighton, Dodge V	Physcia leucomela, Anaptychia squarrosa	synonym	

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
Heterodermia podocarpa																				c								pantropical	island			
Heterodermia propagulifera																		x	x	c	c	xc						pantropical	island			
Heterodermia speciosa	x				x			x	x	x	x		x	x	x				x		c	xc	x		x	x		pantropical		Leighton	Physcia speciosa	synonym
Heterodermia verruculifera																			x			c	c					pantropical	island			
Hyperphyscia adglutinata									x		x				x	x												cosmopolitan	island			
Hyperphyscia granulata																	x				c							pantropical	island			
Lecanactis subabietina																					c							Europe	S. Hemisphere			
Lecanactis epileuca																					c		c					S. America	Africa			
Lecanographa farinulenta								x	x					x	x		x	x							x	x		S. America	Africa			
Lecanora cf barkmaniana																					c							Europe	ID uncertain			
Lecanora cf compallens																											27c	Europe	ID uncertain			

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25								
Lecanora cf confusa																										c		Europe	ID uncertain				
Lecanora cf expallens																				c	c							Europe	ID uncertain				
Lecanora jamesii																										27c	Europe, Macaronesia	S. Hemisphere					
Lecanora cf leprosa												c									c		c					pantropical	ID uncertain				
Lecanora pseudistera	x			x	x				x		x		x	x	x	x	x	x								x	x		pantropical	island			
Lecanora sanctae-helenae	x		x	x	x	x		x	x	x	x	xc	x	x	x	x	x	x	c	x	xc	x	c	x	x		endemic & Ascension	trees	Dodge V, Dickhauser et al				
Lecanora sulfurescens								x	x																			pantropical	island				
Lecanora tropica																			c		c							pantropical	island	Dodge V	Lecanora aequinoctialis	new synonym	
Lecidea cf leucothallina										x	x																	Europe	ID uncertain				
Lecidella buelliastrum			x		x	x		x	x	x	x	x	x	x	x	x	x	x								x	x	S. America, Australia	Africa	Leighton, Dodge V	Lecanora, Aspicilia personata	new synonym	
Lecidella chodati					x	x		x	x	x	x	x	x	x	x	x	x	x								x	x	S. hemisphere, Europe & Macaronesia	island	Leighton, Dodge V	Huea, Lecidea, Blastenia lactescens	new synonym	

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
Lepraria cf lobificans	x								x	x	x		x	x	x		x	x	x	x	xc	x		x	x			cosmopolitan	ID uncertain			
Lepraria sipmanianum									x	x		x		x	x	x	x	x		x	x	x		x	x			pantropical	island	Leighton	Lepraria ochracea	wrong ID
Lepraria usnica	x		x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x		x	x			pantropical	island			
Lepraria xerophila	x												x	x	x													N. America, Europe	S. Hemisphere			
Leprocaulon arbusculum																								x				pantropical	island			
Leprocaulon tenellum												x	x					x	x					x	x			pantropical	island			
Leptogium azureum																					c	c						pantropical	island			
Leptogium cochleatum																		x										pantropical	island			
Leptogium cyanescens	x				x					x	xc	x	x					x	x						x			cosmopolitan		Leighton	Leptogium tremelloides	synonym
Leptogium millegranum																												pantropical	island			
Lobaria patinifera																				c	c	c						pantropical	island	Leighton	Ricasolia herbacea	wrong ID

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25									
Megalaria albocincta																				c	c	c						Europe, America & Macaronesia	S. Hemisphere					
Megalospora tuberculosa																			c	xc	xc	xc						pantropical	island					
Milospium graphideorum																					x							Europe, America & Macaronesia	S. Hemisphere					
Normandina pulchella																		x	x	c	xc	xc	xc					cosmopolitan	island					
Ochrolechia tartarea							x		x											c					x			N. Hemisphere	S. Hemisphere, trees					
Opegrapha corticola																				c		c						Europe	S. Hemisphere					
Opegrapha culmigena																						c						cosmopolitan	island					
Opegrapha saxigena																					x							N. Hemisphere	S. Hemisphere					
Opegrapha subelevata							x																			x			N. Hemisphere	S. Hemisphere				
Pannaria cf conoplea												x									c	xc						cosmopolitan	ID uncertain					
Pannaria fulvescens																					c							pantropical	island					

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25								
Pannaria tavaresii																			x									Europe, Macaronesia	island	Leighton	Pannaria rubiginosa	wrong ID	
Parmelinopsis horrescens																					c								pantropical	island			
Parmelinopsis minarum																										27c		pantropical	island	Leighton, Dodge III	Parmelia suffixa, saxatilis	wrong ID	
Parmelinopsis spumosa												c							c	c	c							pantropical		Hale 1976	Parmelina spumosa	synonym	
Parmotrema austrosinense	x							x		x	x	x	x	x	x	x	x	x	c							x		pantropical	island	Leighton	Parmelia laevigata	wrong ID	
Parmotrema crinitum																			c	c						x		cosmopolitan	island				
Parmotrema grayanum									x	x																		Europe, Africa, Macaronesia	island	Leighton	Parmelia perlata	wrong ID	
Parmotrema mellissii																			c	c	xc							pantropical		Dodge III	Parmelia mellissii	synonym	
Parmotrema tinctorum																					x							pantropical	island				
Peltula euploca					x	x			x	x						x				x	x					x		cosmopolitan	island				
Peltula impressa						x				x																		pantropical	island				

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
<i>Peltula obscurans</i>					x				x																			pantropical	island			
<i>Pertusaria hymenea</i>																	x	x	c	c								cosmopolitan	island			
<i>Pertusaria pertusa</i>																					x			x				cosmopolitan	island			
<i>Pertusaria subventosa</i>																		x	c	xc	xc							pantropical	island			
<i>Peterjamesia circumscriptum</i>																	x							x				cosmopolitan	Africa			
<i>Phaeophyscia hispidula</i>									x	x							x				xc							pantropical	island			
<i>Phyllopsora buettneri</i>																			c									pantropical	island			
<i>Physcia atrostriata</i>																			c									pantropical	island			
<i>Physcia dimidiata</i>																					c							cosmopolitan	island			
<i>Physcia soresiodosa</i>	x							x	x	x			x	x	x	x		c	xc	xc			x	x				pantropical	island			
<i>Porina cf chlorotica</i>																	x											cosmopolitan	ID uncertain			



Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25						
Porina coralloidea																					c						Europe, Macaronesia	S. Hemisphere			
Porina nucula																					c						pantropical	island			
Protopannaria pezizoides																					c						cosmopolitan	island			
Pseudocyphellaria aurata											x						x	x	c	xc	xc					cosmopolitan		Leighton	Sticta aurata	synonym	
Pseudocyphellaria crocata																				c						cosmopolitan		Leighton	Stictina crocata	synonym	
Pseudopyrenula diluta																				c						pantropical	island				
Psilolechia lucida																			x	x	xc	x				cosmopolitan	island				
Psora cerebriformis	x		x		x				x	x		x			x											America	S. Hemisphere				
Psoroglaena cubensis																				c						pantropical	island				
Psorotichia cf schaeereri						x																				cosmopolitan	ID uncertain				
Punctelia stictica																	x									Europe, Africa, America & Macaronesia	island				

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
Pyrenula acutispora																			c	c								Macaronesia	S. Hemisphere			
Pyrenula laevigata																					c							Europe, America & Macaronesia	Africa			
Pyrenula macrocarpa																											28c	pantropical	island			
Pyrenula sp.																				c								id uncertain	ID uncertain			
Pyxine cocoes											x																	pantropical	island			
Pyxine daedalea											x																	pantropical	island			
Pyxine petricola									x	x			x		x	x	x									x	pantropical	island				
Pyxine subcinerea														x														pantropical	island			
Ramalina arabum							x					xc			x	x	x				c				x	x	Macaronesia & Africa		Krog, Leighton, Dodge V	Ramalina angulosa, maculata	partly wrong ID	
Ramalina geniculatella sp. nov.			x				x					x		x			x								x	x	endemic	science				
Ramalina ketner-oostreae sp. nov.												x	x		x	x										x	endemic	science				

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25									
Ramalina lacera																	x												pantropical	island	Leighton	Ramalina pollinaria, polymorpha	wrong ID	
Ramalina maderensis							x							x		x										x	x			Macaronesia	S. Hemisphere			
Ramalina nervulosa																												30c		pantropical	island			
Ramalina peruviana																			c		c									pantropical	island			
Ramalina rigidella sp. nov.			x	x			x			x	x	x	x	x	x	x	x	x	x		x					x	x			endemic	science	Leighton	Ramalina ceruchis	wrong ID
Ramalina sanctae-helenae sp. nov.	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x						x	x			endemic	science	Leighton	Ramalina scopolorum	wrong ID
Rimelia clavulifera																														pantropical	island			
Rimelia pseudoreticulata																											x			Europe & Macaronesia	S. Hemisphere			
Rimelia reticulata	x		x	x	x	x	x	x	x	x	xc	x	x	x	x	x	x	x	xc	xc	xc	xc			x	x				cosmopolitan		Hale & Fletcher, Dodge	Parmelia cazengensis, sanctae-helenae	partly wrong ID
Rinodina oxydata					x								x			x											x			cosmopolitan	island			
Roccella allorgei	x		x		x	x	x		x	x	xc	x	x	x	x	x	x	x	xc		x					x	x			Europe & Macaronesia	S. Hemisphere			

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
Roccella endocrocea							x							x										x	x		Africa	island	Leighton	Roccella tinctoria	wrong ID	
Roccella montagnei																											30c	Africa & Asia	island			
Roccellina accedens																					x				x		Chile	Africa				
Roccellina jamesii						x	x		x							x	x										Ascension	island				
Sarcographa tricolor																			c								pantropical	island				
Sticta fuliginosa																				c							cosmopolitan	island				
Sticta tomentosa																				c							pantropical		Leighton	Stictina tomentosa	synonym	
Syncesia decussans										x						x	x										C. & S. America	S. Hemisphere				
Syncesia effusa																											C. & S. America	S. Hemisphere				
Teloschistes flavicans			x	x								xc	x	x	x	x	x	x	xc	xc	xc			x	x		cosmopolitan		Leighton	Physcia flavicans	synonym	
Tephromela atra																			x	x							cosmopolitan	island				

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
<i>Thelopsis isiaca</i>										x																		pantropical	Africa			
<i>Thelotrema lepadinum</i>																			x	x								cosmopolitan	island			
<i>Toninia aromatica</i>														x														cosmopolitan	island			
<i>Toninia austroafricana</i>																	x											S. Africa	island			
<i>Toninia ruginosa</i>				x																								Africa	island			
<i>Toninia sedifolia</i>	x				x											x												cosmopolitan	island			
<i>Trapelia coarctata</i>																				x								cosmopolitan	island			
<i>Trapeliopsis gelatinosa</i>																					x							cosmopolitan	island			
<i>Usnea baileyi</i>																			c	c	xc	x			x	x		pantropical	rock, island	Leighton	Usnea florida	wrong ID
<i>Usnea dasaea</i>																			c									pantropical	island	Leighton	Usnea hirta	wrong ID
<i>Usnea exasperata</i>																										x		Africa	island			

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
Usnea firmula																				c							Africa	island	Leighton	Usnea ceratina	wrong ID	
Usnea leprosa																			c	c								Africa	island	Leighton	Usnea laevis	wrong ID
Usnea liechtensteinii																							x				Africa	island				
Usnea pulvinata											x							x		x							Europe, Africa	island				
Usnea rubicunda																			c	c	xc						cosmopolitan	island				
Verrucaria cf fuscella																		x									cosmopolitan	ID uncertain				
Waynea stoechadiana								x								x											Europe, N. Africa	S. Hemisphere				
Xanthoparmelia alabamensis								x				x	x	x	x									x	x		N. America	S. Hemisphere				
Xanthoparmelia beccae sp. nov.											x	x					x								x		endemic	science				
Xanthoparmelia caliginosa					x							x					x	x							x		Africa	island				
Xanthoparmelia molybdiza	x			x	x	x		x	x	x	x	x	x	x	x	x	x							x	x		Africa	island				

Species	Area																									Misc.	Distribution	New To	Earlier Report	Name In Report	Status	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25							
Xanthoparmelia phaeophana		x										x					x								x			Africa, Australia	island			
Xanthoparmelia pseudocongensis	x				x	x		x	x	x	x	x		x	x	x									x	x		Africa	island			
Xanthoparmelia squamans														x														Africa	island			
Xanthoparmelia subramigera	x		x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x				x	x		pantropical	island	Leighton	Parmelia conspersa	wrong ID
Xanthoparmelia wildeae												x	x												x		endemic		Dodge III, Hale 1990	Parmelia wildeae, mougeotii	partly wrong ID	
Xanthoria parietina																	x	x									cosmopolitan	island				

**Table 3 Lichens Historically Recorded but Not Found**

Species further reported; not found	Misc.	Distribution	Earlier Report	Name In Report	Status
Cladia aggregata		pantropical	Leighton	Cladonia aggregata	synonym
Cladonia chlorophaea		cosmopolitan	Leighton		
Cladonia pyxidata		cosmopolitan	Leighton		
Dictyonema glabratum		pantropical	Leighton	Cora pavonia	synonym
Teloschistes scorigenus		Europe, Africa	Dodge V		
<i>Extra species in Natural History Museum</i>	Misc.	Distribution	Earlier Report	Name In Report	Status
Calicium hyperelloides	Oakland house	pantropical	island		





Species	Area								Distribution if not on St Helena	New To
	31	32	33	34	35	36	37	38		
<i>Buellia tesserata</i>			x		x	x				island
<i>Byssoloma subdiscordans</i>							c			island
<i>Caloplaca cf bolacina</i>	x	x	xc	x	x	x	x	x		island
<i>Caloplaca crenularia</i>			x	x						island
<i>Caloplaca cf dalmatica</i>		x		x		x	x	x		island
<i>Caloplaca flavocitrina</i>							x	x		island
<i>Caloplaca flavovirescens</i>				x				x		island
<i>Candelaria concolor</i>			x							island
<i>Canoparmelia carneopruinata</i>						x			pantropical	island
<i>Chrysothrix xanthina</i>		x	xc	x	x	xc	xc	x		island
<i>Cladonia chlorophaea</i>							x	x	cosmopolitan	island



Species	Area								Distribution if not on St Helena	New To
	31	32	33	34	35	36	37	38		
<i>Dirinaria confluens</i>		x	x	x	x	xc		x	pantropical	
<i>Dirinaria flava</i>		x	xc	x	x	xc		x		
<i>Endocarpon pallidum</i>								x		island
<i>Endocarpon pusillum</i>			x	x			x			island
<i>Enterographa anguinella</i>					x					island
<i>Euopsis pulvinata</i>			x							island
<i>Fellhanera bouteillei</i>							c			island
<i>Flavoparmelia soledians</i>										island
<i>Graphis elegans</i>							c			island
<i>Haematomma fenzlianum</i>					x	x		x		
<i>Hafellia leptoclinoides</i>				x						island

Species	Area								Distribution if not on St Helena	New To
	31	32	33	34	35	36	37	38		
Heterodermia galactophylla							xc			island
Heterodermia leucomela							c			
Heterodermia obscurata							xc		pantropical	island
Heterodermia podocarpa							xc			island
Heterodermia propagulifera							xc			island
Heterodermia speciosa							xc			island
Heterodermia verruculifera							x			island
Hyperphyscia adglutinata			c		x	c				island
Lecanographa farinulenta								x		island
Lecanora leprosa			c			c				island
Lecanora pseudistera	x	x	xc		x					island

Species	Area								Distribution if not on St Helena	New To
	31	32	33	34	35	36	37	38		
<i>Lecanora sanctae-helenae</i>					x	x		x		island
<i>Lecanora sulfurescens</i>										island
<i>Lecanora sulphurella</i>			x	x	x	x				island
<i>Lecidella chodati</i>		x				x	x	x		island
<i>Lepraria cf lobificans</i>			x		x	x				island
<i>Lepraria sipmanianum</i>							x			island
<i>Lepraria usnica</i>		x	xc	x	x	x	x	x		island
<i>Leptogium cyanescens</i>				x			xc	x		island
<i>Megalospora tuberculosa</i>							xc			island
<i>Milospium graphideorum</i>								x		island
<i>Normandina pulchella</i>							xc			island

Species	Area								Distribution if not on St Helena	New To
	31	32	33	34	35	36	37	38		
Ochrolechia tartarea					x	x		x		
Opegrapha multipuncta					x				Europe, Macaronesia	island
Opegrapha subelevata				x	x					island
Parmelinopsis minarum						x	xc			island
Parmotrema austrosinense						x	x			island
Parmotrema crinitum					x	x				island
Parmotrema grayanum						x				island
Peltula euploca	x	x	xc	x		x				island
Peltula obscurans	x	x	c							island
Pertusaria flavicans			x	x	x					island
Pertusaria pertusa								x		island

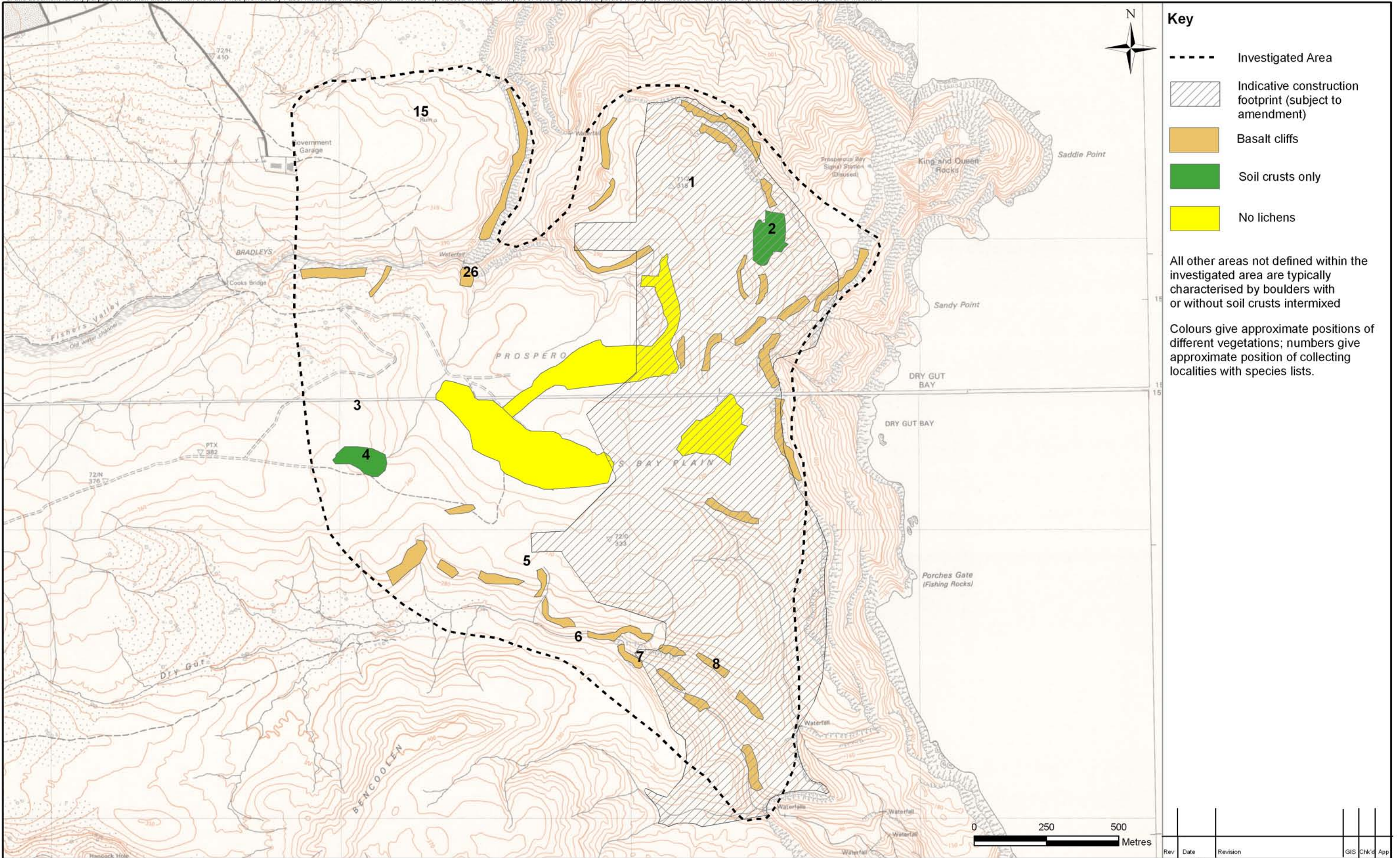
Species	Area								Distribution if not on St Helena	New To
	31	32	33	34	35	36	37	38		
<i>Pertusaria</i> sp.						x				island
<i>Physcia atrostriata</i>							xc			island
<i>Physcia poncinsii</i>			c				x			island
<i>Physcia solediosa</i>		x	xc	x	x		x			island
<i>Pseudocyphellaria crocata</i>							c			island
<i>Pyxine petricola</i>		x		x	x	x				island
<i>Ramalina mollissima</i> sp. nov.							xc	x		island
<i>Ramalina nervulosa</i>							x			island
<i>Ramalina peruviana</i>					x	xc	x	xc		island
<i>Rimelia cetrata</i>						x			pantropical	
<i>Rimelia reticulata</i>			xc	x	x	xc	xc	xc		island



Species	Area								Distribution if not on St Helena	New To
	31	32	33	34	35	36	37	38		
Rinodina sp.			c							island
Roccella allorgei				x	x	x	x	x		island
Roccella montagnei			x							island
Roccellina jamesii				x	x	x		x		
Roccellina suffruticosa							x		S. America	Africa
Sticta weigeli							x		pantropical	island
Teloschistes flavicans				x	x	xc	xc	xc		
Trypethelium ochroleucum							c			island
Usnea baileyi							c			island
Usnea dasaea							c			island
Usnea rubicunda							xc			island

Species	Area								Distribution if not on St Helena	New To
	31	32	33	34	35	36	37	38		
Xanthoparmelia alabamensis				x		x				island
Xanthoparmelia molybdiza			x							island
Xanthoparmelia pseudocongensis				x						island
Xanthoparmelia subramigera		x	xc	x	x	x		x		island

# Figures



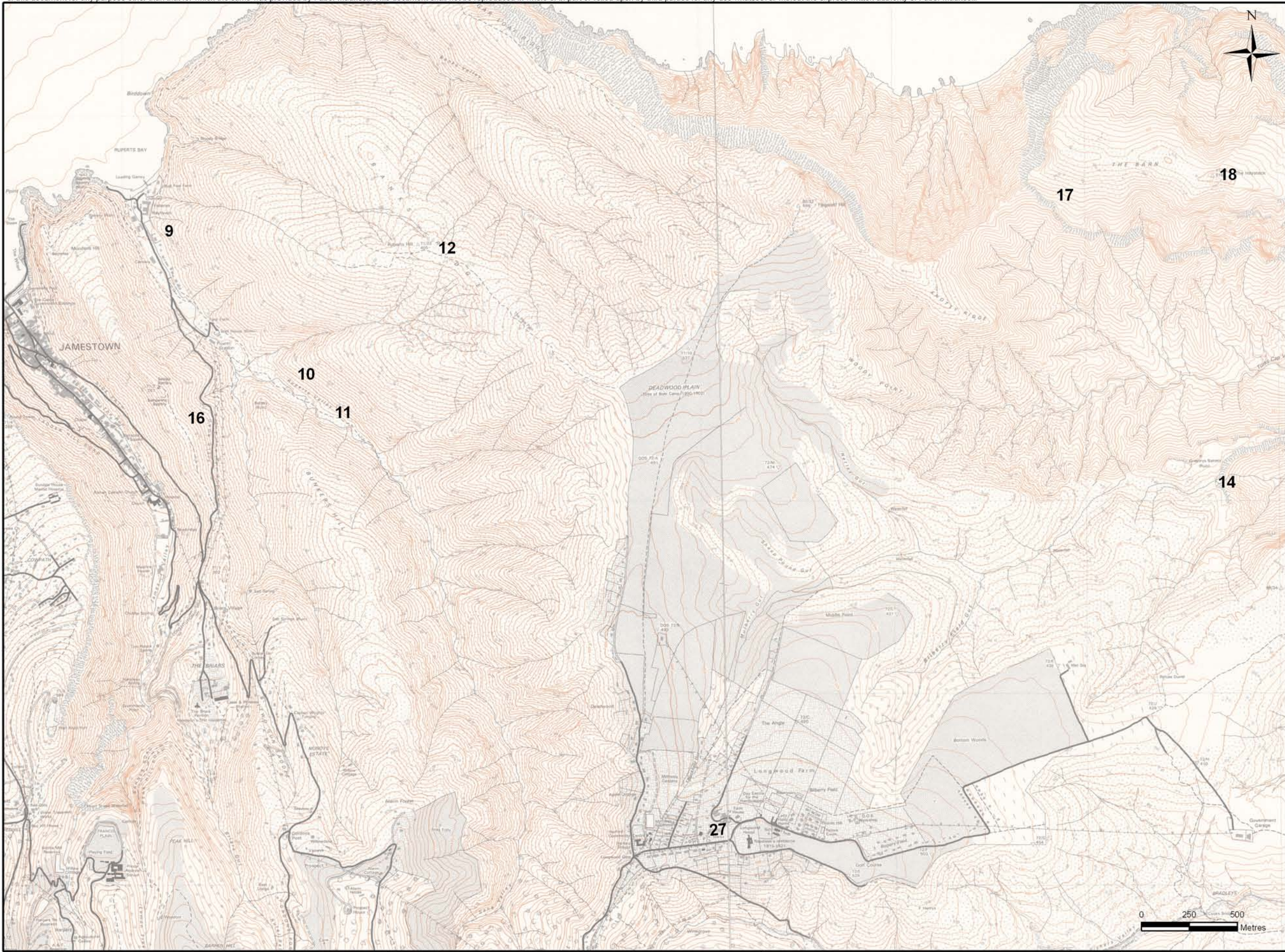
- Key**
- Investigated Area
  - Indicative construction footprint (subject to amendment)
  - Basalt cliffs
  - Soil crusts only
  - No lichens

All other areas not defined within the investigated area are typically characterised by boulders with or without soil crusts intermixed

Colours give approximate positions of different vegetations; numbers give approximate position of collecting localities with species lists.

Rev	Date	Revision	GIS	Chk'd	App

Client: DFID	Title: <b>FIGURE 1 LICHEN VEGETATION ON PROSPEROUS BAY PLAIN</b>	<b>FABER MAUNSELL   AECOM</b>	GIS: CS	Chk'd: IAB	E
Project: ST. HELENA ACCESS- EIA STAGE 1 REPORT		Dunedin House 25 Ravelston Terrace Edinburgh, EH4 3TP	Tel: +44 (0) 131 311 4000 Fax: +44 (0) 131 311 4090 www.fabermaunsell.com	App'd: IAB	Status: DRAFT
				Date: 02/01/07	Scale: 1:12,000
No. FIGURE 1				Rev:	



**Key**

Numbers give approximate position of collecting localities with species lists.

Rev	Date	Revision	GIS	Chk'd	App

Client:	DFID
Project:	ST. HELENA ACCESS- EIA STAGE 1 REPORT

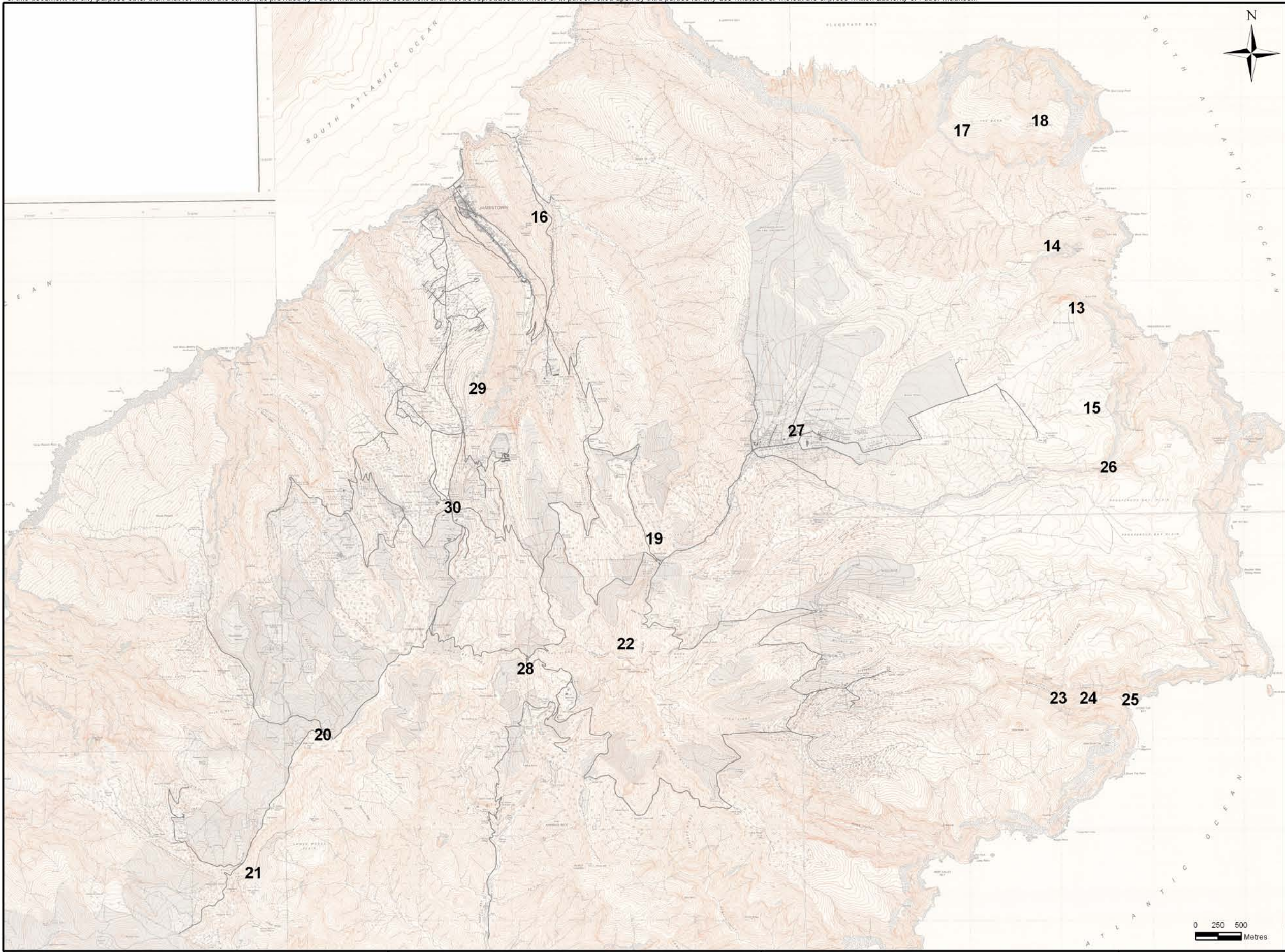
Title:	<b>FIGURE 2 LICHEN STUDY LOCALITIES ON THE ACCESS ROAD TRACK AND ITS SURROUNDINGS</b>
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**FABER MAUNSELL | AECOM**

Dunedin House  
25 Ravelston Terrace  
Edinburgh, EH4 3TP

Tel: +44 (0) 131 311 4000  
Fax: +44 (0) 131 311 4090  
www.fabermaunsell.com

GIS:	CS	Chk'd:	IAB
App'd:	IAB	Status:	DRAFT
Date:	03/01/07	Scale:	1:20,000
<b>No.</b>	<b>FIGURE 2</b>	Rev:	



**Key**

Numbers give approximate position of collecting localities with species lists.

Rev	Date	Revision	GIS	Chk'd	App

Client: DFID
Project: ST. HELENA ACCESS-EIA STAGE 1 REPORT

Title: **FIGURE 3  
LICHEN STUDY LOCALITIES  
IN OTHER AREAS**

**FABER MAUNSELL | AECOM**

Dunedin House  
25 Ravelston Terrace  
Edinburgh, EH4 3TP

Tel: +44 (0) 131 311 4000  
Fax: +44 (0) 131 311 4090  
www.fabermaunsell.com

GIS: CS	Chk'd: IAB	E
App'd: IAB	Status: DRAFT	
Date: 16/01/07	Scale: 1:40,000	Rev:
<b>No. FIGURE 3</b>		

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# Sites Studied In Detail for Lichens